



Are We Really Engaging
and Motivating our
Mathematically Gifted?

Hello!

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I am also a graduate student in my final semester at UNC Charlotte.



Access Today's Presentation

<http://bit.ly/engagingmathgifted>



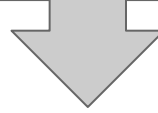
Our Session Goals



Today we will...

- ▶ explore the issue of maintaining or increasing engagement and motivation levels in our mathematically gifted elementary students
- ▶ review research supporting the importance of addressing this issue
- ▶ consider a proposed research study as a means to gaining a deeper understanding of this issue
- ▶ examine a variety of strategies that can be implemented in classrooms to increase engagement and motivation without sacrificing a high levels of rigor

Overview of the issue



Review of research



Proposed study



**Strategies and
resources**

Our Time Together





A small glimpse into the mind of a teacher

The Issue



Do elementary school teachers have enough strategies and resources to consistently engage and motivate their mathematically gifted students?

Characteristics of Engagement & Motivation

Engagement:

- ▷ Interested
- ▷ Actively engaged
- ▷ On task
- ▷ Curious
- ▷ Asks questions
- ▷ Interactive
- ▷ Receptive

Motivation:

- ▷ Perseveres
- ▷ Driven
- ▷ Positive attitude
- ▷ Determined
- ▷ High levels of effort
- ▷ Responsive
- ▷ Problem solver

Why is this Issue Important?

- ▶ Many mathematically gifted students are grouped in classrooms containing students with heterogeneous abilities.
- ▶ Gifted students often do not need the repetitive structure of whole group classroom lessons.
- ▶ Completing work that has already been mastered can lead to boredom and disengagement.
- ▶ Students develop intrinsic motivation through their accomplishments.

- ▶ Maintaining and increasing these affective characteristics can help prevent underachievement.
- ▶ It is not always easy to ascertain a student's level of engagement and motivation when they have already mastered grade level content and are compliant with daily tasks and assignments.
- ▶ It can be challenging for teachers to effectively address this issue in their classrooms.

What Does the Research Say?

- ▶ Mathematically gifted students require rich, **rigorous**, **engaging**, authentic learning **experiences** to thrive (Dimitriadis, 2009).
- ▶ Mathematically gifted students often **fail to realize** their **potential** (Gavin, Casa, Adelson, Carroll, & Sheffield, 2009; Ysseldyke, Tardrew, Betts, Thill, & Hannigan, 2004).
- ▶ Mathematically gifted students who receive **engaging** instruction that maintains their interest are **less likely** to **underachieve** later on in middle and high school (Reed, 2004).

- ▶ One study found the most **popular** type of **differentiation** for the students is having the opportunity to **personalize** their learning experiences (Kanevsky, 2011).
- ▶ Another study suggested that the **Accelerated Math program** provided appropriate **differentiated** opportunities for students. Other program benefits such as flexibility with student **pacing** and **ease of use** for teachers were also mentioned (Ysseldyke, Tardrew, Betts, Thill, & Hannigan, 2004).
- ▶ Students with **strong mathematical ability** are better recognized through activities such as **problem-based learning** completed within the classroom (Trinter, Moon, & Brighton, 2015).

Let's Process

- ▶ What are your reactions to the research?
- ▶ Does the research correlate with what you are observing in the classroom?



Limitations to Prior Research

- ▶ Many past research studies have focused only on academic achievement as a means of successfully educating a child.
- ▶ Engagement and motivation are not usually acknowledged in research even though each contribute to academic achievement.

- ▶ Affective characteristics are important to address when considering short and long term student success. However, studies related to this issue seem to be lacking in prior research.
- ▶ Previous research does not often include educational practices that take into account the whole child. The emphasis is mainly focused on achievement in the form of assessments.

Proposed Research



My Focus:



To study the impact of regular classroom differentiation strategies on engagement and motivation of mathematically gifted students.

Research Purpose & Question

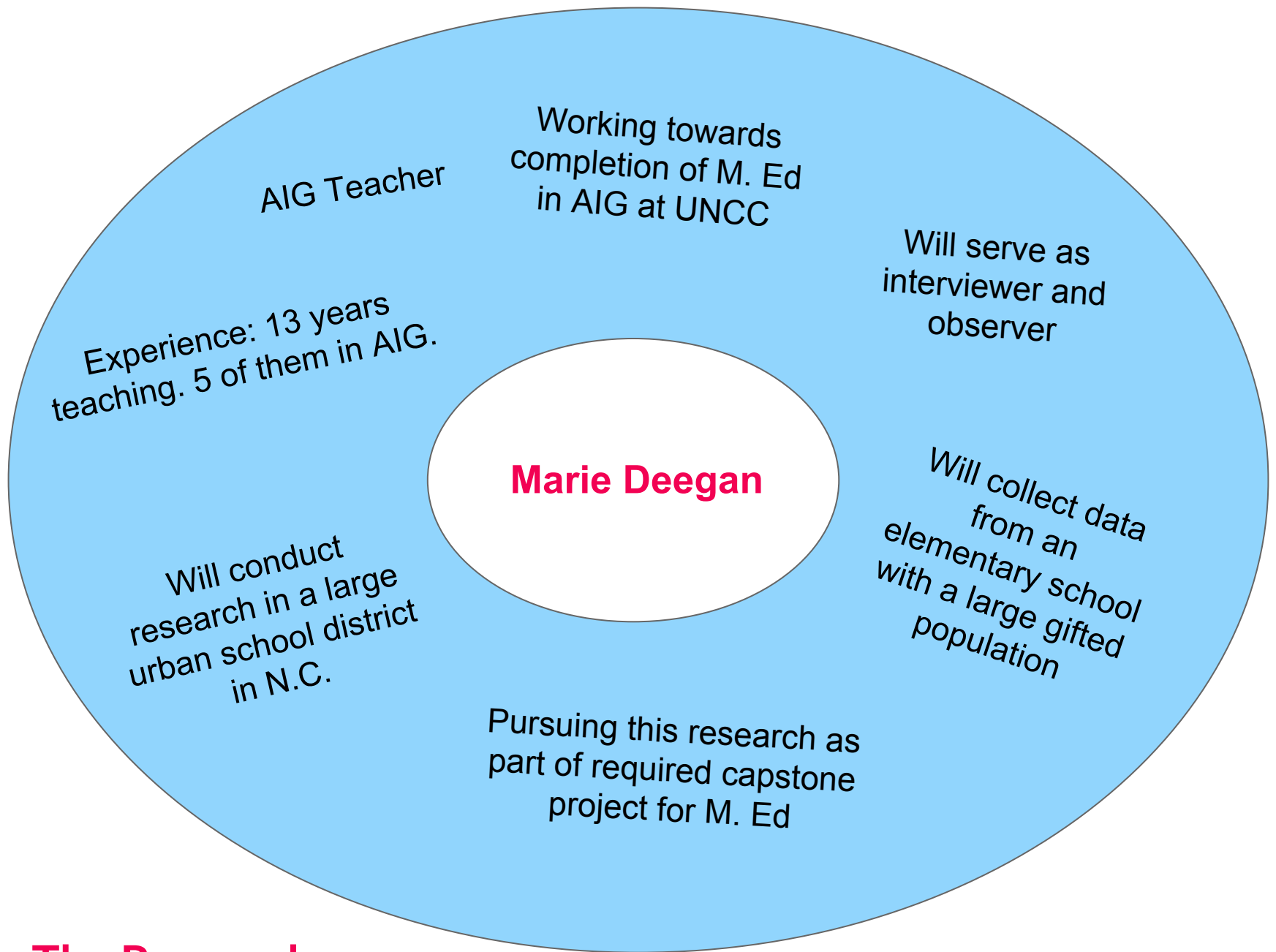
- ▶ Purpose: to examine the impact of regular classroom differentiation strategies on engagement and motivation in mathematically gifted students.
- ▶ Question: Do regular classroom differentiation practices effectively address engagement and motivation in mathematically gifted students?

Research Design

- ▶ Using a qualitative case study design, I will gather data through interviews, observations, and journal entries to help gain a rich and thorough understanding of mathematically gifted students and their perceived levels of engagement and motivation in a heterogeneous classroom setting.

Participants

- ▶ Ten students in fifth grade chosen from an elementary school that uses a cluster grouping model for its gifted population.
- ▶ Selected from a group of students identified by an urban North Carolina school district as gifted or mathematically gifted.
- ▶ Participants demonstrate an exceptional ability during math instruction, and performed at the highest achievement levels on the beginning of year Measure of Academic Progress (MAP) assessment (NWEA, 2015).
- ▶ Non-probability, purposeful sampling method used to select participants.



The Researcher

Research Procedures



Identify Participants



Uphold Ethical Practices



Data Collection



Discussion of Results



Reliability & Validity



Data Analysis

Identify Participants

- ▶ Classroom teachers identified gifted students who consistently displayed advanced mathematical abilities during instructional time, were the most challenging to differentiate for, and also performed at the highest percentiles on the beginning of year MAP assessment (NWEA, 2015).

Uphold Ethical Practices

- ▶ The researcher was granted permission to conduct the study after completing the IRB process for UNCC.
- ▶ Informed consent will be received from all participants.
- ▶ Assessment data will be collected from the school district's Office of Accountability.
- ▶ All information collected will be stored in a secure location.
- ▶ Digital files will be password protected.

Data Collection

- ▶ To gain a rich understanding of students' experiences related to their engagement and motivation during math class, the researcher will begin to collect three different points of data.
- ▶ The researcher will observe participants during two separate instances of math instruction time.
- ▶ Data will also be collected through researcher-generated journal prompts.
- ▶ Students will participate in a semi-structured one-on-one interview with the researcher.

Data Collection Tools

Observation Tool to Assess Student Engagement a Motivation

Examples of Engagement, Motivation, & Interest <ul style="list-style-type: none">• Active listening/participation (interactive, receptive)• Follows directions• Responsive• On task• Enthusiastic, positive• Curious, shows interest in activity• Asks questions• Displays a "Can Do" attitude• Self-motivated• Problem solver• Strong levels of task commitment• Puts forth high quality effort• Perseveres• Takes pride in work	Observer Notes:
Non-Examples of Engagement, Motivation, & Interest <ul style="list-style-type: none">• Averse to participating in class• Openly or quietly resists tasks• Displays off-task behavior• Distracted (daydreaming, doing an unrelated activity, etc.)• Appears disinterested• Passive• Low levels of motivation/task commitment• Minimal amount of work completed (just enough to get by)• Lacks independence• Takes a long time to complete work or completes it too fast	Observer Notes:

Journal Prompts

1. What has been your favorite math activity so far this year? Describe it and why you enjoyed it so much. Was it challenging for you? How?
2. How hard do you have to try to do well in math? What does your teacher do if you already understand something?
3. Think about what you do each day during math class. What type of activities capture your attention the most? Why do you think that is?
4. Do you think your teacher knows when a math topic is easy for you? Do you feel like they try to challenge you? In what ways do they challenge you?
5. Do you enjoy math class? Is it interesting? Is it challenging? Explain.
6. What do you wish you could say to your teacher about your experiences in math class? If you could make one change, what would it be? Why?

Interview Questions

1. Think of a time when you felt really interested and excited about something you were doing in math. Tell me about that time. Possible follow-up questions: Why did you like it so much? Was it challenging for you? How?
2. If you could plan math class for a day, what would the students learn about? Possible follow-up questions: Would something like that ever happen in your class? Why or why not?
3. Tell me about a typical day in math class?
4. What is it like for you during a math lesson? What is it like for you during math workshop time?
5. Think about math class as a puzzle. Consider all of the different pieces. Describe what pieces you would change if you could.
6. If a new student came to your class, and they were really strong in math, what would you want them to know to expect?

Data Analysis

- ▶ The researcher will concurrently begin the **data reduction** process while still collecting information from students.
- ▶ The **written notes** from **observations** will be developed into detailed **field notes** immediately following each session.
- ▶ **Interviews** will be **transcribed** verbatim using Merriam's (2009) interview transcript suggestions.

- ▶ The completed **journal entries** will be **examined** using a systematic approach for discovering important findings (Merriam, 2009).
- ▶ The data reduction process will continue by **coding** the information to determine what categories, patterns, and **themes** are beginning to **emerge** (Merriam, 2009).
- ▶ **Data reconstruction** will determine **findings**, lead to **conclusions**, and help **connections** be made to existing literature.

Reliability & Validity

- ▶ **Member checking** will be used with the participant identification process for classroom teachers, the observation instrument, the questionnaire, as well as the interview questions. This will be done to help **avoid misinterpreting information** obtained from the participants (Merriam, 2009).
- ▶ **Triangulation** approach will be utilized to help strengthen the dependability and **internal validity** of the results.

Discussion of Findings

Please stay tuned!

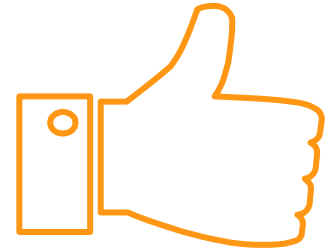
I will be uploading my final results to this presentation once the research has been completed.

If you are interested in learning what I discover, please send me your email address and I would be happy to contact you when my findings have been added.

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Strategy and Resource Integration

What Can You Do?



► Teach skills for independent learning

For example:

- What it means to become independent
- How to plan or structure your time
- How to manage work independently
- What to do if you are stuck
- How to signal for teacher help
- What expectations are about noise, talking, etc.
- Rules about materials
- Guidelines for choice activities
- What to do when tasks are completed

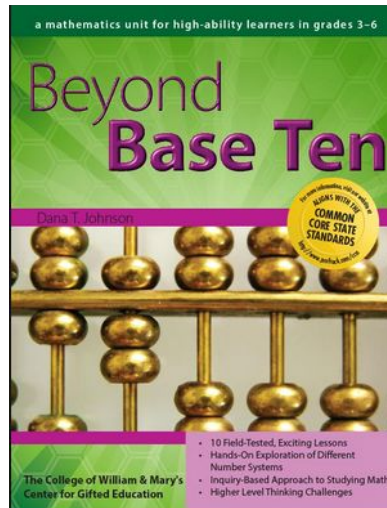
Plan High Quality Anchor Activities

Why? It's simple...because students rarely finish work at the same time and need to be working productively while at school.

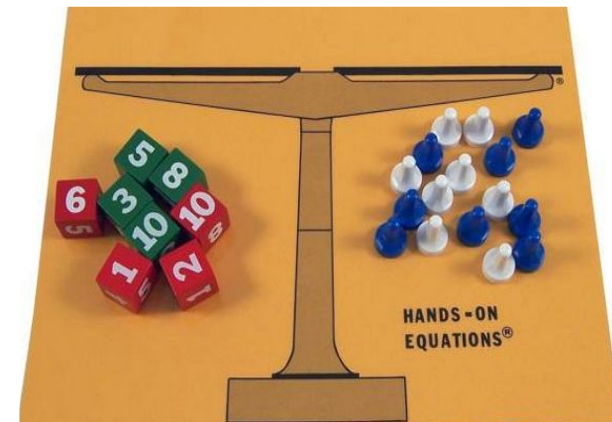
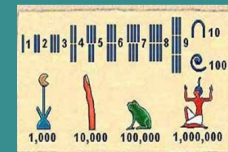
Tips to ensure effectiveness:

- ▶ High quality anchor activities are **not** busy work
- ▶ They can be done independently during whole group instruction or collaboratively during workshop or center time
- ▶ They are engaging and tied to standards
- ▶ They must have clear directions to proceed independently
- ▶ They can be short term or long term
- ▶ They should be authentic
- ▶ They integrate any or all of the following: content areas, real world scenarios, hands on experiences, or technology
- ▶ They are planned with an awareness of the 5 c's of Student Engagement: control, choice, challenge, complexity, caring (Delisle, 2012)

- Beyond Base Ten
- Hands On Equations
- M3: Mentoring Mathematical Minds
- Ancient forms of math (Vedic, Egyptian, Russian Peasant, etc.)



<http://www.youtube.com/watch?v=xTOHkuYwQYw>



Utilize Contracts

- ▷ RAFTS
- ▷ Choice Boards
- ▷ Think Dots

Hands-On Equations R.A.F.T

Role	Audience	Format	Topic
blue pawn	red number cube	letter	My Legal Move is better than yours!
red number cube	balance scale	directions	How Legal Move #2 works
balance scale	blue pawns & red number cubes	song or rap	why we must "reset to check"
third grade Hands-On Equations expert	third graders who have not used Hands-On Equations	public service announcement	why balance is so important and other important algebraic concepts
Your Choice <i>*must be approved*</i>	Your Choice <i>*must be approved*</i>	Your Choice <i>*must be approved*</i>	Your Choice <i>*must be approved*</i>

R. A. F. T.

Choice Board

Math Choice Board: Multiplication, Division, and Order of Operations

Directions: Select three activities in a row to complete. You may choose to work horizontally, vertically, or diagonally. Try your best and be sure to complete each activity carefully. Show all of your work. When you are finished, you may choose to complete additional activities for an extra challenge.

A 3-digit number is multiplied by a 2-digit number and the calculation is written out as shown below. Each star stands for one digit. Apart from the zero shown, the only digits that occur are 2, 3, 5 and 7. This is sufficient information to find the product of this equation. Can you manipulate the numbers to find the product?

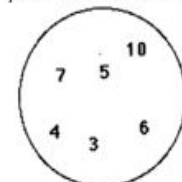
$$\begin{array}{r} \star \star \star \\ \star \star \\ \hline \star \star \star \star \star \\ \star \star \star \star \star 0 \\ \hline \star \star \star \star \star \end{array}$$

Multiplication Equation Sudoku: You will need a copy of this activity to complete it. If you are truly having trouble, or need help locating an error, you may use the answer key to help guide you.

The amount of garbage produced by people in the U.S. each year is astronomical! Conduct some research to determine your best estimates for the following questions below.

- What is the approximate weight of garbage produced each year in tons?
- Approximately how many people currently reside in the U.S.?
- About how many pounds of garbage does each person in the U.S. produce every month?

Write a number sentence using every digit in the circle only once. Use all four operations, as well as parentheses and brackets if necessary. When you are finished, your answer needs to equal 3.



A number N is divided by 3 and the result is multiplied by 7. Then 6 is subtracted from the result to give 36. Write the correct equation for this problem and find the value of N .

Can you create a challenge problem similar to this one? Make sure it can be solved, then test a buddy to see if they can find the solution.

In the multiplication problem below, some of the digits have been replaced by letters. Others have been replaced by asterisks. Where a digit has been replaced by a letter, the same letter is used each time. Different letters have replaced different digits. Can you reconstruct the original multiplication?

$$\begin{array}{r} A B C \\ B A C \\ \hline \star \star \star \star \\ \star \star A \\ \hline \star \star \star B \\ \hline \star \star \star \star \star \end{array}$$

Ms. Daddona and Mrs. Kiser had \$500 to invest in the stock market. Ms. Daddona bought shares of Ford Motor Co. at \$10 per share while Mrs. Kiser bought shares of General Electric Co. at \$20 per share. Ms. Daddona's shares went up in value \$0.20 per share. Mrs. Kiser's shares went up \$0.50 per share. How much did each earn on their shares? Who made the better investment? Use your

Multiplication Square: You will need a copy of a multiplication board and the Multiplication Square sheet to complete this activity.

Carlos wants to learn to play golf, but he wants some more information before he begins. He learned that the local 18-hole golf course is 6,550 yards long. It is a par 72 course, which means that a good golfer should play the entire course with a total of 72 strokes.

- What is the average distance for each hole (rounded to the nearest whole number)?
- What is the average number of

Think Dots

Decimal Enrichment Problems

Directions: Roll a number cube to determine which problems to solve. Solve each problem that matches the number you rolled. Please respond to at least four out of the six problems. Be sure to explain your thinking and show all of your work for each problem.



If two apples and three bananas cost \$0.51, while four apples and seven bananas cost \$1.11, what is the cost of one apple and five bananas?



You are taking an eight-day, 3,500-mile trip. Use the information below to determine which car rental will give you the best deal. How do you know?

Justin's Car Rental: \$30 a day + \$.08 a mile OR \$200 a week + \$.08 a mile.

Kelly's Car Rental: \$25 a day + \$.10 a mile OR \$140 a week + \$.10 a mile.



At the Seeds-Be-Gone Watermelon Stand, Farmer Green charges a fixed amount for the first three watermelons you buy and an extra amount for each additional watermelon. If seven melons cost \$16.00 and ten melons are \$22.00, what is the fixed price for the first three watermelons?



At Donna's Deli, salads are \$0.21 an ounce and an empty plate weighs three ounces. What is the cost if the scale reads 1.25 pounds?



Alphonso's parents are building a new home. The house costs \$65 a square foot, the deck is \$7.50 a square foot, the driveway \$3.00 a square foot and the fence is \$8.60 a linear foot. What is the total cost of a 1,900 square foot house with a 12 by 15 foot deck, a 720 square foot driveway and 420 feet of fencing?



Johna and her three friends order the same thing for lunch except Johna's extra slice of pizza for \$1.25. If the total bill is \$10.45, what is Johna's share?

Become Comfortable Using Open Ended Activities

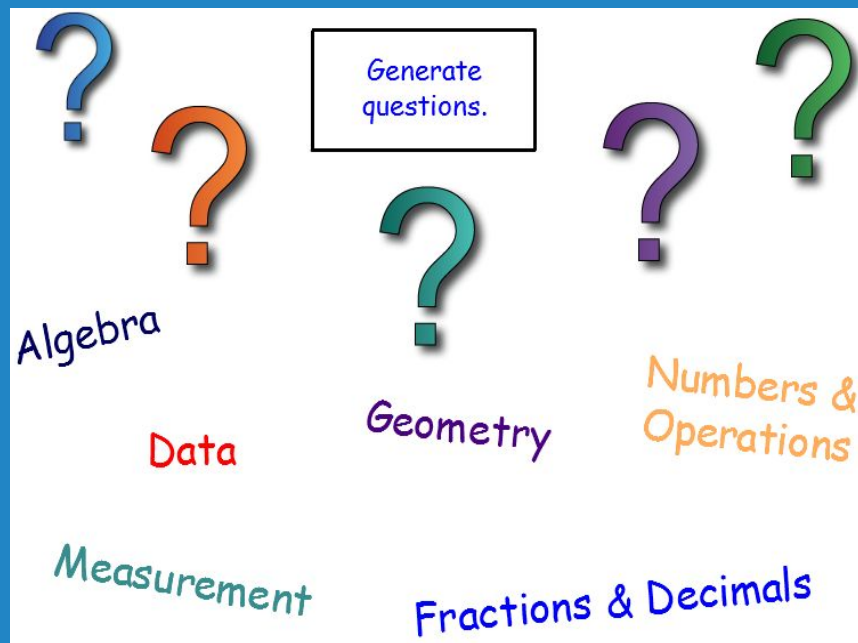
- ▷ Project Based Learning
- ▷ Problem Based Learning
- ▷ Math Genius Hour

Food Truck Fiasco



Problem Based Learning

Math Genius Hour



Let's Party!

5th Grade PBL

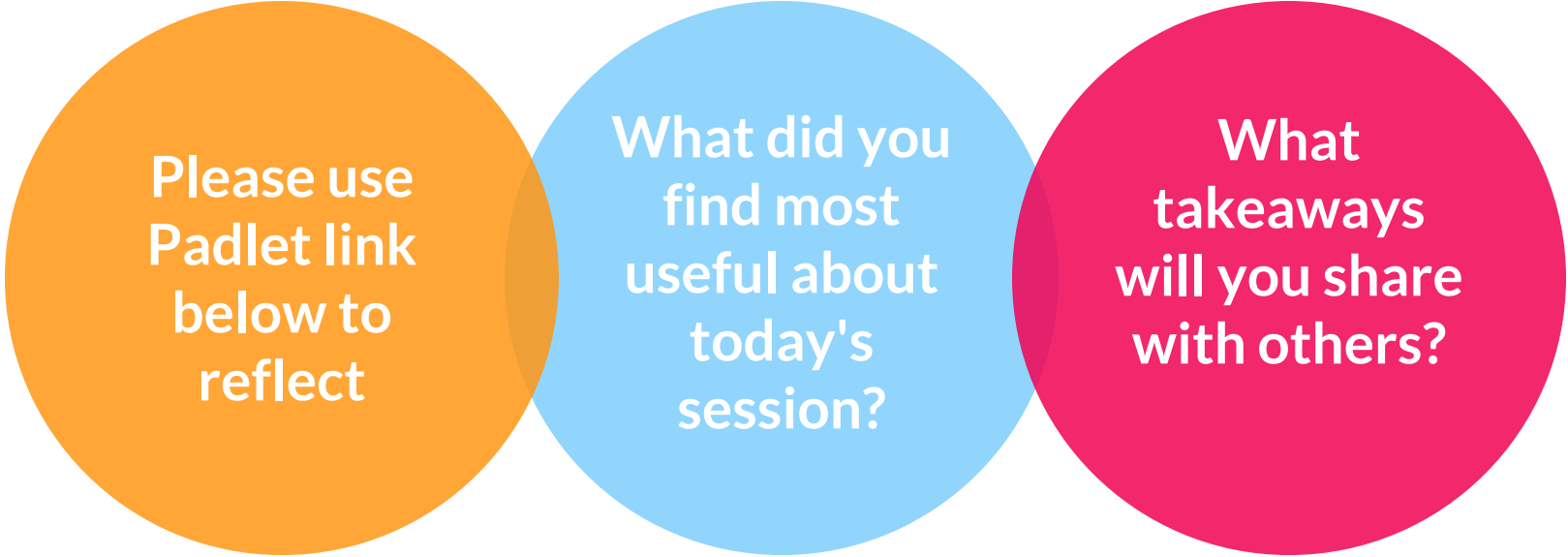
Your Challenge

You and a group of classmates own a student-run catering company. Your company is bidding on a job to plan a birthday party for a 13-year old (you may decide the gender). Given a budget of \$250, your job is to work together to develop a party proposal for 30 guests that includes a budget spreadsheet, written description of party and events, menu, recipes, coordinate map of the party room, and an oral presentation.



Project Based Learning

Reflections and Takeaways



Please use
Padlet link
below to
reflect

What did you
find most
useful about
today's
session?

What
takeaways
will you share
with others?

<http://padlet.com/mdeegan1/engagegiftedmath>

Thanks!

Any questions?

You can find me at:

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